City and County of Honolulu
Drought Mitigation Strategies

Prepared for:

Oahu Drought Committee

and

State of Hawaii
Department of Land and Natural Resources
Commission on Water Resource Management

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TABLE OF CONTENTS

Page

1 INTRODUCTION

As part of a statewide effort to address and mitigate the effects of natural hazards, the City and County of Honolulu has undertaken the development of strategies to mitigate the effects of drought. Drought is one of the most obstinate and pernicious of natural disasters which at its most severe form decimates crops and livestock, erodes the landscape, damages terrestrial and aquatic wildlife habitat, contributes to widespread wildfire, and results in hundreds of millions of dollars in damage. Drought moves slowly and manifests after months of below normal precipitation, and recovery requires much more than one good rainfall. Drought results from both climatic conditions and from human activities that increase demand for water.

Drought can lead to tough decisions regarding allocation of water, stringent water-use limitations in large urban areas, problems in ensuring safe drinking water and adequate water supplies for fire fighting efforts. In the past, drought was addressed as a temporary emergency. Actions were taken in response to impacts in a reactionary fashion. The most important lesson learned in recent years is that the best time to reduce the impacts of drought is before they occur. Therefore, it is important to develop a plan that advocates a proactive drought management approach. The *City and County of Honolulu Drought Mitigation Strategies* was developed with this approach in mind.

This report presents the mitigation strategies developed by the Oahu Drought Committee as a result of workshops that were held on August 18 and September 14, 2004. The State Commission on Water Resource Management (CWRM), in cooperation with the State Civil Defense (CD), received Federal Emergency Management Agency (FEMA) assistance to develop county drought mitigation strategies. Workshops were undertaken to compile an inventory of existing drought mitigation programs, identify data gaps, identify drought risk areas, and recommend and prioritize drought mitigation projects. The Oahu Drought Committee has decided it will continue to meet regularly and earnestly work towards implementing the mitigation projects identified during the workshops.

2 BACKGROUND

The preparation of County Drought Mitigation Strategies is a part of a larger statewide drought-planning framework. Statewide drought planning is guided by the *Hawaii Drought Plan* (HDP), which was most recently updated in 2004. In addition, drought mitigation planning is incorporated into the forthcoming *State of Hawaii Hazard Mitigation Plan* and each of the respective *County Multi-Hazard Pre-Disaster Mitigation Plans*.

2.1 Hawaii Drought Plan

The *Hawaii Drought Plan* provides a coordinated and consistent program and framework for integrating federal, State, county and private sector actions to reduce drought impacts. The plan is intended to serve as a working guide for those agencies and private entities that have the capabilities and resources to develop drought response and mitigation programs within their areas of jurisdiction.

The HDP includes a description of historical drought occurrences, current monitoring programs by federal, State and local agencies, climatological statistics, and risk assessments of susceptibility and vulnerability to drought. The plan emphasizes the identification of pre- and post- drought preparedness and mitigation measures for implementation by government agencies, stakeholders, and the general public.

The HDP recognizes County/Local Drought Committees (CLDCs) as integral elements for effective implementation of drought planning and mitigation. The plan anticipates that CLDCs will be the first to identify drought effects, be responsible for initial implementation of mitigation activities, and generally be the first to respond to and manage public health, safety and fire related issues.

2.2 State of Hawaii Hazard Mitigation Plan

To meet the requirements of the Disaster Management Act of 2000 and the planning guidelines by the Federal Emergency Management Agency, the State Department of Defense, Civil Defense Division is preparing the *State of Hawaii Hazard Mitigation Plan*, as well as plans for each of the four counties. At the time of this writing, the completion of the plan was anticipated by December 2004.

The Federal Disaster Management Act of 2000 requires each state and territory to conduct hazard mitigation planning and to implement projects to reduce hazard impacts prior to a disaster occurrence. This Act marked a fundamental shift in policy. Rather than placing primary emphasis on response and recovery, FEMA's focus broadened to incorporate mitigation as the foundation of emergency management.

Future funding for public assistance subsequent to disasters will be largely contingent upon mitigation plan completion. Additionally, states are required to have an

approved Standard State Mitigation Plan in order to receive additional Pre-Disaster Mitigation funds for state or local mitigation projects after November 1, 2004.

The Standard State Mitigation Plan will also be required for non-emergency assistance provided under the Stafford Act, including Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program funding. A state with a FEMA-approved Enhanced State Mitigation Plan at the time of a disaster declaration is eligible to receive increased funds under the Hazard Mitigation Grant Program, based on 20 percent of the total estimated eligible Stafford Act assistance. Therefore, the development of state and local hazard mitigation plans is key to maintaining eligibility for future FEMA mitigation and disaster recovery funding.

The *State of Hawaii Hazard Mitigation Plan* will encompass the broadest possible scope of disaster occurrences, focusing on nine natural hazards: hurricanes, tsunami, earthquakes, floods, volcanic eruptions and lava flow, coastal erosion, landslides, wildfire, and drought. Several of these hazard categories have current advisory boards or task forces that will be developing recommendations and strategies.

It is anticipated that some of the drought mitigation projects identified by CLDCs will be incorporated into the county and State hazard mitigation plans, thereby allowing these areas to be eligible for future assistance from FEMA.

2.3 County Multi-Hazard Pre-Disaster Mitigation Plan

The Disaster Mitigation Act of 2000 also requires the development of local or county plans for that particular county to be eligible for post-disaster funding. The purpose of these requirements is to ensure that there are local programs and projects in place that will help minimize the loss of life, property, and total cost of disasters.

Similar to the *State of Hawaii Hazard Mitigation Plan*, the county plans have been designed as multi-hazard pre-disaster mitigation plans. The initial *County Multi-Hazard Pre-Disaster Mitigation Plans* did not detail specific drought mitigation projects.

2.3.1 County Drought Mitigation Strategies

In order to develop county-specific drought mitigation strategies, the Commission on Water Resource Management conducted a series of workshops within each county. The resulting county-specific drought mitigation strategies can be incorporated into each *County Multi-Hazard Pre-Disaster Mitigation Plan*. Formulation of these mitigation strategies resulted in the development of specific project proposals, which are documented in this *Drought Mitigation Strategies* report. The CLDC and the county can then choose to seek funding for these projects through FEMA or other

sources. The CLDC will have the lead role in implementing projects identified in their *Drought Mitigation Strategies* with assistance from the State Civil Defense Division, the Hawaii Drought Council, and the State Drought Coordinator.

The primary objectives of the county workshops were to establish standing CLDCs and improve the coordination and implementation of local drought mitigation and response actions. The CLDCs play a key role in Hawaii's drought leadership structure by providing directives and allowing for stakeholder representation at the county/local level. Improved coordination and project implementation will arise from better communication between government agencies and the private sector, from enhanced monitoring and data collection, and through the development of immediate and near-term drought mitigation strategies.

The expected outcomes of the county workshops included the following:

1. Identification of current mitigation measures and existing data gaps in drought information/planning;
2. Development and prioritization of county-based drought mitigation strategies, including ranking criteria for project selection and identification of priority mitigation projects which may be eligible for agency funding.
3. Transition from "emergency response" to early "proactive" mitigation;
4. Improved post-drought impact assessment; and
5. Validation of drought response/mitigation measures.

3 OAHU DROUGHT COMMITTEE

3.1 Membership and Leadership

The Oahu County/Local Drought Committee (hereafter referred to as "Oahu Drought Committee") is comprised of representatives from key governmental agencies, non-governmental organizations, and major landowners with an active interest in drought-related issues. Based on participation in the drought workshops, the present membership includes the following agencies and entities:

- Oahu Civil Defense
- Honolulu Board of Water Supply (BWS)
- Honolulu Fire Department
- Department of Agriculture (DOA)
- Department of Hawaiian Home Lands (DHHL)
- Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR, DOFAW)
- Department of Land and Natural Resources, Division of Aquatic Resources (DLNR, DAR)
- US Department of Agriculture, Farm Service Agency (FSA)

- US Department of Agriculture, Natural Resource Conservation Service (NRCS)
- U.S. Department of the Army
- U.S. Geological Survey (USGS)
- Navy Public Works Center
- Aina Hui Corporation
- Hawaii Cattlemen's Council
- Hawaii Farm Bureau Federation
- Hawaii Hotel and Lodging Association
- Koolau Mountains Watershed Partnership
- The Nature Conservancy

Representatives participated in workshop sessions held in August and September 2004 and shared local knowledge and information about current drought conditions, and past experiences coping with drought. Through facilitated discussion, the group collectively developed local and regional drought mitigation strategies to minimize the effects of drought upon domestic and municipal water supplies, fire suppression activities, agricultural water use, commerce, and the environment.

Committee members participating in the workshops generally agreed that this is a worthwhile effort deserving of continuation. Messrs. Doug Aton, Acting Administrator for Oahu Civil Defense, Barry Usagawa, Principal Executive of Water Resources, Honolulu Board of Water Supply, and Jason Shitanishi, County Executive Director, U.S. Department of Agriculture, Farm Service Agency, have volunteered to co-chair the Committee.

3.2 Relationship to State Drought Leadership

The *Hawaii Drought Plan* establishes a drought leadership structure that, in addition to the County/Local Drought Committees, consists of the Hawaii Drought Council, the State Drought Coordinator, and the Water Resources Committee. The purpose of each of these groups/entities and their relationship to the Oahu Drought Committee is as follows:

Hawaii Drought Council. The Hawaii Drought Council is the steering group that oversees the statewide coordination of drought-related activities. The Drought Council currently functions within existing agency authorities and responsibilities, and facilitates access to services and/or assistance to lessen the impacts of drought.

The Drought Council serves as the liaison between the various entities involved with drought planning/response, including the Oahu Drought Committee and the Office of the Governor. It also assumes the lead role in intergovernmental drought response coordination and media information releases.

State Drought Coordinator. The State Drought Coordinator is responsible for coordinating drought-related actions and communications between federal, State, and county agencies, stakeholders, and the general public. The State Drought Coordinator position resides in the Commission on Water Resource Management.

The State Drought Coordinator will serve as the principal liaison between the Oahu Drought Committee, the Hawaii Drought Council, Water Resources Committee, and other government agencies.

Water Resources Committee. The Water Resources Committee monitors all available climatological data, reservoir storage levels, ground water conditions, weather forecasts and other pertinent information necessary to analyze the current status and forecasted level of drought conditions throughout the State.

Information gathered by the Water Resources Committee will be available to the Oahu Drought Committee through the State Drought website and reports distributed by the State Drought Coordinator.

3.3 Role and Responsibilities

3.3.1 Coordination and Communication with Government Agencies and Stakeholders

The Oahu Drought Committee will serve as a focal point for the exchange of information between federal, State, and county agencies, local stakeholders, and the Hawaii Drought Council. The Oahu Drought Committee will be responsible for monitoring drought conditions, gathering data, and forwarding information to the Hawaii Drought Council via the State Drought Coordinator. In turn, the State Drought Coordinator will provide data gathered by the Water Resources Committee to the Oahu Drought Committee for distribution to local agencies and stakeholders.

3.3.2 Data Collection and Drought Monitoring

The Oahu Drought Committee is uniquely qualified to provide information on crop and livestock impacts, reservoir water levels, stream conditions, ground water levels, and other drought issues at the County level. The Oahu Drought Committee should assist in monitoring ground water levels, stream/ditch conditions, and reservoir levels. The Oahu Drought Committee should also monitor and assess current and potential impacts of impending or ongoing drought, focusing upon impacts to the local economy, the environment, and natural resources.

Following each drought event, the Oahu Drought Committee should take the lead in conducting post-drought evaluations. Post-drought evaluations will assist in documenting statewide drought impacts and will serve to assess the effectiveness of

specific response and mitigation measures implemented at both the State and county level. Upon development, the State Drought Coordinator will assist the Oahu Drought Committee in applying a standardized methodology to document economic, environmental, and social drought impacts.

3.3.3 Mitigation Actions

Planning for drought mitigation activities is a key function of the Oahu Drought Committee. Drought mitigation projects identified by the Oahu Drought Committee are discussed in Chapters 5 and 6 of this report. It is the responsibility of the Oahu Drought Committee to carry out activities in pursuit of the following:

- Further refinement and/or delineation of areas of drought risk;
- Application, receipt and administration of funds for the implementation of identified projects; and
- Provision of oversight and management of project implementation.

The State Drought Coordinator, the Hawaii Drought Council, and the Water Resources Committee are available to provide the Oahu Drought Committee with technical assistance and aid in the identification and acquisition of funds for project implementation. The Oahu Drought Committee is also responsible for the periodic review and appropriate revision of county drought mitigation strategies, adding, deleting or refining projects to reflect changing circumstances and priorities.

3.3.4 Response Actions

During drought, the Oahu Drought Committee will be responsible for initiating appropriate and coordinated drought response activities within the capabilities of local government agencies, and any State or federal drought programs. The Oahu Drought Committee should advise the Hawaii Drought Council of any needs that cannot be met through existing County resources. The Oahu Drought Committee will be the point of contact for the State Drought Coordinator relative to providing drought information and seeking assistance for response actions and documentation of impacts. The activities of the Oahu Drought Committee during drought periods should include the following actions:

- Meet at least semi-annually to discuss drought impacts and planned response actions;
- Monitor drought impacts and communicate this information to the Hawaii Drought Council via the State Drought Coordinator;
- Make recommendations as necessary for the issuance of county/local drought declarations in coordination with the Hawaii Drought Council and other County offices and agencies; and

- Provide for outreach activities targeting affected stakeholders with the purpose of determining needs, identifying detailed emergency assistance response actions or projects, and requesting relief funding from the appropriate source with assistance from the State Drought Coordinator.

4 DROUGHT RISK AND VULNERABILITY FOR THE CITY AND COUNTY OF HONOLULU

In September 2003, the Commission on Water Resource Management completed a statewide *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. The risk and vulnerability assessment illustrates the spatial extent and severity of drought risk for different impact sectors throughout the state. Areas in the City and County of Honolulu identified in the report as subject to drought risk are shown in the table below.

City and County of Honolulu Drought Risk Areas			
Sector	**Drought Stage**		
	Moderate	**Severe**	**Extreme**
Water Supply	Central Oahu (Mililani / Waipio)	Central Oahu	Ewa, Haleiwa
Agriculture and Commerce	Central Oahu from Kunia to Helemano	Kunia	North of Helemano
Environment, Public Health & Safety (based on 12-month time scale)	Central Oahu near Mililani	Central Oahu near Mililani and Kunia	Waipio / Pearl City

Adapted from: Table 6.3 Drought Risk Areas for the City and County of Honolulu, *Drought Risk and Vulnerability Assessment and GIS Mapping Project*, prepared for the State Commission on Water Resource Management, September 2003

The Oahu Drought Committee examined the findings of the drought risk report and, through group discussion of areas of concern and drought impact sector issues, generated a revised list of specific geographic areas of the county that are most susceptible to drought. With regard to wildland fire risk, it was noted that areas with less than 30 inches of annual rainfall should be considered severe or extreme risk areas. With regard to water supply risk areas, the Honolulu Board of Water Supply noted that because most of the island is served by an interconnected system, water can be moved to areas of need, which reduces drought risk. However, the Tantalus/Roundtop is a subject to drought risk because it is served by catchment systems.

The table below summarizes the areas identified by the group as having the highest drought risk:

Drought Risk Areas Identified by the Oahu Drought Committee	
Impact Sector	**Drought Risk Areas**
Water Supply	Tantalus/Roundtop
Agriculture and Commerce	Central Oahu: Waialua, Haleiwa, Kunia, Honouliuli Leeward Coast between Waianae and Nanakuli and Maili Windward Oahu: Laie to Kahuku, Waiahole, Waimanalo
Wildland Fire and Environment	All areas with less than 30 inches of annual rainfall East Oahu Leeward Oahu Central Oahu Sedimentation areas of concern: Waialua-Kaika Bay Moo Gulch area

5 EXISTING DROUGHT RESPONSE AND MITIGATION ACTIVITIES FOR THE CITY AND COUNTY OF HONOLULU

The following sections summarize the existing drought response and mitigation efforts and programs in the City and County of Honolulu. "Drought response" refers to emergency actions that are implemented directly in response to drought conditions. "Drought mitigation" is defined as short- and long-term actions and/or programs that may be implemented prior to, during, and after drought events to reduce the degree of risk to human life, property, and the economy. Drought response and mitigation activities are presented for each of three impact sectors: Wildland Fire and Environment; Agriculture and Commerce; and Water Supply. Challenges and issues related to these existing programs are also summarized.

5.1 Current Drought Response Activities

5.1.1 Wildland Fire and Environment Responses

The Nature Conservancy (TNC) noted that the July 2004 wildfire in Kunia was successfully extinguished with great cooperation from multiple agencies. A fire response plan for the Waianae mountains is being completed, however, better coordination for requesting support from the Army is needed. The Army is

developing a firing range next to a TNC forest reserve and pyrotechnics are a concern.

The Army is installing a new helicopter dip tank at Schofield Barracks to improve fire response time. The Honolulu Fire Department also purchases brush gear apparatus, such as lighter hoses, for quicker wildland fire response.

The City has received a Homeland Security Grant to purchase new communication equipment. The equipment will assist with coordination when responding to wildland fires.

5.1.2 Agriculture and Commerce Responses

The Department of Agriculture maintains two irrigation systems serving Waimanalo and Kahuku agriculture parks. The Waimanalo agriculture park has a storage reservoir. There is a tiered water use restriction that is implemented during drought where 10% to 30% cutbacks can be instituted as needed based on reservoir levels and drought intensity.

The cattle industry is concerned about the availability of stock water and forage during drought. Additional storage tanks and wells have been installed to prepare for drought. The use of low moisture drought-resistant forage and improved irrigation systems are also being examined. Ranchers would like to harvest guinea grass from fallow agriculture lands prior to the onset of drought. This would make forage available for cattle while reducing fuel for wildfires. Silage can also be made out of grass. There is a need to have an inventory of where there are fallow agricultural lands with guinea grass.

5.1.3 Water Supply Responses

The Honolulu Board of Water Supply (BWS) has conservation rules in place when rainfall is below normal. When 3 or more BWS index wells experience water levels in low groundwater conditions as defined in Section 3-318 to 3-323, BWS Rules & Regulations, BWS can implement progressive water conservation measures from voluntary to mandatory water use schedules and use restrictions. In critical low groundwater conditions, BWS can install flow restrictors on meters, implement inverse pricing and discontinue water service.

BWS implements public service announcements and a year-round water conservation media campaign to inform the public on the current drought situation and remind the public to conserve where possible.

5.2 Current Drought Mitigation Activities

5.2.1 Wildland Fire and Environment Mitigation

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has a number of drought mitigation programs in place. DOFAW's programs and activities relating to wildland fire mitigation include:

1. Administering the National Fire Plan grant to reduce wildland fire hazard at the wildland/urban interface. A grant was awarded to the Nature Conservancy for a project in Waianae and Newtown Estates for fuel abatement.
2. A Firewise program coordinator is available for community outreach, fire training and prevention workshops, educational programs for schools, and county fairs.
3. Developing a fire danger rating system, which will hopefully be maintained at the Maui Pacific Disaster Center. There is a need to coordinate with BWS for installation of remote automated weather stations (RAWS). A RAWS was installed in Waianae Kai two years ago with the Army. Data is available on the internet.
4. DOFAW is developing Fire Management Plans for communities at risk. Management Plans have been prepared for the Makaha and Waianae Kai areas, however, additional studies should be conducted to inventory values, hazards and risks.
5. Issuing media press releases to raise wildfire awareness.
6. Commenting on plans and providing recommendations for Firewise Developments and fire-safe construction during City zone-change proceedings.

Other wildland fire mitigation efforts include those by the Honolulu Fire Department (HFD) which receives funds from Volunteer Fire Assistance grants ($50,000 to $60,000 annually). The HFD also conducts an educational program to reduce risk at the wildland/urban interface. In addition, the City has an ordinance requiring clearing vacant lots to reduce fire danger and the Pacific Disaster Center is conducting a risk hazard analysis looking at fuel types along the urban interface to develop wildland fire mitigation measures. Grazing to reduce fire loading is being pursued in Makakilo where lands have been leased to allow grazing.

Finally, many public and private entities, including the Board of Water Supply, are undertaking watershed management initiatives to preserve and rehabilitate forest watersheds. There are presently nine watershed partnerships statewide encompassing approximately 1,000,000 acres. These partnerships include public and private landowners working together to manage forest resources for their water recharge and other conservation values. On Oahu, the Koolau Mountains Watershed Partnership includes 15 landowning members and covers nearly 100,000 acres. However, public and private financial resources available for managing

forested watersheds are limited. The protection and rehabilitation of forested watersheds is important to the prevention and mitigation of drought effects.

5.2.2 Agriculture and Commerce Mitigation

The State Department of Health; Department of Business, Economic Development and Tourism; and the Hawaii Chamber of Commerce formed a partnership to develop the Hawaii Green Business Program to assist and recognize businesses that operate in an environmentally responsible way. The Green Business Program promotes water and energy conservation, waste reduction, and pollution prevention focusing initially on the hotel industry with plans to expand the program to other businesses.

The Hawaii Hotel and Lodging Association has joined with the Green Business Program partners to provide water conservation cards in hotel rooms, which give guests the option of not laundering their towels and bed linen on a daily basis. Restaurants also have table tent cards informing guests that drinking water will be provided upon request.

5.2.3 Water Supply Mitigation

The Honolulu Board of Water Supply has a number of drought mitigation and water conservation programs and activities. These activities include:

1. Demand-Side Management Programs:
    a. From 1990 to 2004 BWS estimates approximately 1.0 mgd per year has been saved from demand-side management programs. Island wide pumpage in 2004 is 157 mgd, the same as in 1990.
    b. BWS has a successful toilet rebate program for residential replacements to low flow toilets. From its inception in 1998, BWS has funded $100 rebates for residential retrofits amounting to $400,000 annually. The program will continue until 2008.
    c. In coordination with BWS, the City Council passed an ordinance requiring the retrofit of all non-residential fixtures to low flow and require all new construction utilize low flow fixtures. BWS has retrofitted all City facilities to low flow fixtures up to the avoided development costs of new wells based on expected water saved.
    d. The University of Hawaii, Manoa campus is being retrofitted and Senator Inouye has introduced legislation to mandate the retrofit of State buildings. BWS impact fee for new service connections is structured to encourage low flow fixture installations.
    e. A demonstration project that studies the effectiveness of rainwater catchment barrels for residential irrigation.

f. BWS is partnering with HECO to develop a rebate program for water and energy efficient "Energy Star" washing machines to save water and energy. A $100 rebate will be piloted in 2005.
g. Promotion of rain sensors to allow residential and commercial developments to accurately irrigate their landscaping when needed. Landscape irrigation and lack of rainfall during the summer makes a significant difference in BWS pumpage—130 mgd in winter vs. 180 mgd in the summer.
h. BWS internal conservation program increases leak detection and pipeline replacement programs for older water lines to tighten up the distribution system and reduce real and apparent water losses below 10% of daily water pumpage.

2. Non-potable Water Supply Development:
    a. Kalauao Spring captures flow through spring water from the Sumida Watercress farm at Pearlridge. 800,000 gallons per day of brackish spring water is being used for irrigation of the H-1 Freeway, Hawaiian Cement quarry in Halawa, Aloha Stadium and the Honolulu airport. Additional users such as Keehi Lagoon Park and the military golf courses may be connected to this system in the future.
    b. BWS owns and operates the 12 mgd Honouliuli Water Recycling Facility in Ewa. The facility provides recycled water for the irrigation of Ewa's golf courses, roadway landscaping and parks and for industrial process water for James Campbell Industrial Park.
    c. The BWS, DOH, and Army are studying the effects of reuse in Central Oahu, which are over potable aquifers. 2-years of soil aquifer treatment testing has shown that the soil absorbs organic constituents in recycled water and will not impact drinking water supplies. Therefore, BWS and the City Department of Environmental Services will be developing a recycled water system for Central Oahu using Wahiawa wastewater treatment plant recycled water. The system is anticipated on-line in 2008.
    d. Seawater desalination by reverse osmosis is being pursued. A 5 million gallon per day (mgd) project that extracts water from 1,600-foot deep wells is being design and will be on-line at the end of 2006. Seawater desalination will provide drought proof potable water and allow BWS groundwater wells to rest during extended droughts.
    e. Deep seawater cooling for air conditioning systems is a conservation project that will reduce the amount of water lost from conventional air conditioning systems and reduce energy consumed by the cooling process. A seawater district cooling plant is being constructed at the University of Hawaii's John A. Burns School of Medicine Facilities in Kakaako. Approximately 25 million gallons and 1.0 million kilowatt

hours will be saved annually. The use of this technology is being actively pursued in Waikiki, Downtown and in Ewa.

3. Water Resource Management:
    a. BWS has an ongoing program to monitor rainfall and groundwater levels as indicators to improve the distribution of well pumpage to maintain sustainable yields and promote drought recovery.
    b. BWS is partnering with agencies, landowners and organizations in watershed protection partnerships. Forestry management projects are being funded and pursued in the mauka forested lands. These projects include reforestation, invasive species removal, feral animal control, fencing, education and community involvement. Increasing the forests health and biodiversity enhances recharge to groundwater aquifers sustaining water supplies during drought. Healthy forests decrease polluted runoff and flooding.
    c. BWS has created a watershed protection grants process to promote watershed protection projects throughout Oahu.

Other City and County water supply mitigation actions include:

1. Centralized irrigation controls are being installed in Central Oahu District Park and other parks to better control irrigation rates depending on rainfall.
2. The City is looking at amending the subdivision standards to require use of pervious concrete for driveways and swales to increase percolation and reduce runoff, along with economic incentives.
3. BWS and the City and County of Honolulu are developing a Memorandum of Understanding with the State to improve irrigation systems and reduce water waste.

In addition to these programs and activities, the Army is implementing conservation actions such as installing low-flow bath fixtures. The Army is also seeking transfer of water system operations and has a reuse project to irrigate golf courses. Military water systems are interconnected with the BWS water system.

5.3 Existing Gaps in Drought Mitigation

The Oahu Drought Committee reviewed presently available information supporting their drought mitigation efforts and identified gaps in data, related deficiencies and concerns, and offered suggestions for improvements. Mitigation projects were “brainstormed” for the geographic areas that the Committee had identified as being at risk to drought.

5.3.1 Wildland Fire and Environment Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to wildland fire drought impacts:

1. Continue and expand community outreach through the Firewise Program.
2. Complete more detailed wildfire hazard analysis, including consideration of risk/hazard/value relationships.
3. Improve aerial fire-fighting capability.
4. Inventory irrigation and reservoir systems to determine where non-potable and potable supplies are located, and to consider threatened and endangered species protection. Other questions include locating where salt water can be applied, and expanding the use of GIS techniques.
5. Fuel hazard reduction within Wildland-urban interface. Publicize the process whereby communities can apply for grants. Fuel hazard reduction is being done in Newtown Estates and in Leeward Oahu – Makakilo upper Palehua (but not yet into funding).
6. Update intergovernmental agreements.
7. Develop low-flow instream flow standards for environmental protection (native aquatic fauna) during drought. Have an alternate standard to keep water in streams. With drought and the loss of habitat, native species will return, and alien/invasive species may be eliminated.
8. Develop a joint fire-planning group similar to the Big Island Wildfire Coordinating Group.
9. Explore the use of Forested Watershed Management tools to improve ground and surface water management. Develop monitoring tools for impact assessment and restoration evaluation. The Koolau Forest Reserve has a fire management protocol. Following wildland fires, the population of alien species increases in native forested areas.
10. Inventory potential areas for harvesting guinea grass and forage prior to drought to reduce fire danger.
11. Install additional RAWS (many weather stations were lost following exit of sugar plantations). Look into sharing stations with other governmental agencies. Farmers and others need an island wide weather system to monitor and evaluate weather conditions within different microclimates. Should also consider the ability to track wind acceleration, airflow movements, and homeland security considerations.
12. Develop a matrix of projects to compare commonalities among projects across different sectors.
13. Provide additional Wildland Fire training for conservation personnel.
14. Review the fire code for mitigative provisions and talk with construction personnel and insurance companies about fire mitigation.
15. Develop recommendations for new regulations requiring registration of off-road vehicles and dirt bikes since these vehicles can increase fire hazard.

5.3.2 Agriculture and Commerce Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to agriculture drought impacts:

1. Expand agricultural and commerce education and outreach for water conservation practices including roadside vegetation management, composting of soils, etc.
2. Enact State legislation designating drought as a natural disaster and qualifications for disaster assistance, prevention, and incentives for mitigation. Review federal regulations to facilitate and make more understandable the triggers for drought declarations.
3. Explore ways to have more sub-county area federal drought declarations. Relates to the need for remote weather stations.
4. Explore means to increase effluent reuse and develop strategies to reduce institutional hurdles. The City is testing new membrane reactor technology for on-site treatment and reuse directly from sewer lines – decentralizing treatment may be more cost-effective.
5. Investigate the need for a central agency to document and maintain databases of agricultural and other commercial drought losses, rather than individual farmer documentations of losses. NRCS is developing a process to monitor and track conditions.
6. Improve the use of remote sensing and the City's GIS system to monitor drought impacts and climatic changes.
7. Explore combining drought forecasting with economic models for improved farmer decision-making. This could be built from elements of present federal water management practices, but more Hawaii-specific adaptation is needed for local crops and conditions.
8. Inventory and improve irrigation systems. Repair Makaha valley irrigation system (rubber-lined reservoir that needs repair) to support fire fighting and protect existing golf course use.
9. Inventory and assess private irrigation systems for possible future drought mitigation purposes, such as Lake Wilson.

5.3.3 Water Supply Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to water supply drought impacts:

1. Explore potential use of the current storage capacity contained in Lake Wilson for emergency drought purposes. Also explore the use of Nuuanu Reservoir No. 4.
2. Expand reuse, brackish water, and blending applications.

3. Look at developing incentives for recharging caprock supplies with non-potable water (i.e., State policy, water quality considerations, etc).
4. During drought, have a dual system to retrieve sewer effluent or gray water for blending for agricultural use. Public perceptions need to be overcome. Develop exemptions for use during drought. Kunia, Waialua, and Waianae are potential areas where separate reservoirs could be developed. Effluent or gray water may be used depending on water quality, crop type, and irrigation method.
5. To improve the supply of recycled water throughout Oahu, study the benefits of partnering or combining BWS and City wastewater functions.
6. Expand public education for water conservation and science (e.g., reward consumer water savers). BWS now doing water conservation year-round rather than just during summer, schools, media campaign, poster contest, tours of xeriscape garden and Nuuanu watershed.
7. Expand rebate program for new water-saving technologies (e.g. BWS could provide incentives for installation).

6 CITY AND COUNTY OF HONOLULU DROUGHT MITIGATION STRATEGIES

This section summarizes drought mitigation strategies for the City and County of Honolulu based on the input received at the workshop. Committee members described existing drought mitigation programs and efforts, and relayed gaps in data and areas where improvements are needed. Areas susceptible to drought were identified, and various projects were proposed to help mitigate future occurrences of drought. Drought-related discussions of programs, concerns, and proposals were organized into the three main categories of impacts: wildland fire and environment, agriculture and commerce, and water supply.

The goal of the county drought committee workshop was to brainstorm strategies to guide the identification of future mitigation projects and the formulation of project descriptions. The following sections describe:

- Methodology for Project Prioritization
- “High” Priority Projects
- “Other” Priority projects

6.1 Methodology for Project Prioritization

A prioritization process was undertaken by the Oahu Drought Committee to categorize the proposed mitigation projects. This resulted in lists of “high” and “other” priority projects for each impact sector.

Some general guidelines were discussed for consideration during the project prioritization discussion, and are listed below:

- Potential impacts to people;
- Potential impacts to critical natural resources (endangered species habitat, watersheds, cultural resources, erosive soils, etc.);
- Potential impacts to economic resources (jobs, agriculture sector, tax revenues, etc.); and
- Impacts to critical government services (emergency services, water supply, health & human safety).

Generalized timelines were also agreed upon for high priority projects to indicate whether the projects were intended for immediate and/or long-term implementation.

For high priority projects, the Committee members developed detailed project descriptions, utilizing a form developed by the Hawaii Hazard Mitigation Forum. These forms provide project justification and estimated cost information to support the future pursuit of funding and implementation activities. These forms are reproduced in Section 7.3 of this report and should be updated and revised as more information becomes available.

6.2 Summary of "High" Priority Projects

Summaries of the "high" priority projects for all impact sectors with preliminary cost estimates and general implementation time frames, as voted on and agreed to by the committee, are as follows:

Oahu Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
Wildland Fire and Environment	**Firewise Coordinator**. Contract a Firewise Coordinator who will provide guidance and leadership to Oahu's communities at risk by providing information and conducting workshops pertaining to fire prevention and Firewise.	$50,000	Immediate Annual
	Inventory and maintain fire fighting water sources with consideration for threatened and endangered species, develop protocols for salt water use and use of GIS supporting technology.	$100,000 to $125,000	Long term
	Fuel hazard reduction within the wildland urban interface. Prioritize and conduct fuel hazard reduction projects within the wildland/urban interface; assist communities at risk with projects by applying for federal grants targeting fuel hazard reduction projects.	$500,000 Annually	Immediate Annual
	Development of an Oahu Wildfire Coordinating Group. Establish and maintain an interagency approach to wildland fire management programs through the development and nurturing of interagency bonding and facilitation.	Minimal initial cost	Immediate
	Long-term ecological research experimental forested watershed in Hawaii. Explore the use of forested watershed management tools to mitigate the effect of drought and improve ground and surface water management. Also develop monitoring tools to assess the impact of mitigating measures on water resources.	$100,000 Annually	Long term

Oahu Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
	Installation of Remote Automated Weather Stations (RAWS). Purchase and install twelve RAWS units to capture microclimate data for area closure and pre-staging of mobilization of fire equipment.	$210,000	
Agriculture	**Amend existing Federal and State laws to recognize a comprehensive drought program in Federal and State legislation as a natural disaster with proactive mitigation and response.**	Unknown	Long term
	Increase the amount of effluent available for reuse, develop strategies and pilot projects to reduce institutional hurdles.	$3,000,000	Long term
	Documenting agricultural and other commercial losses due to drought. Assemble a third party agency or entities to develop a methodology, strategy, and cost estimates to implement a system to monitor drought conditions and track losses.		Ongoing
	Improve the use of remote sensing and the City's GIS system to monitor drought and climatic changes.	$50,000 to $100,000	Immediate
	Inventory and improve irrigation systems. Repair Makaha valley irrigation system to support fire fighting and protect golf course use. NOTE: This project was combined with Wildland Fire project WF-4. See Project Form WF-4.		

Oahu Drought Committee High Priority Drought Mitigation Projects			
Drought Impact Sector	**Mitigation Project Description**	**Preliminary Cost Estimate**	**Implementation Timeframe**
Water Supply	**Expand reuse, brackish water, and blending applications.** Explore methods to expand the use of reclaimed water, such as by using reclaimed water for agricultural purposes and streamlining City administrative functions such as by partnering or combining BWS and City Wastewater Division functions.	$4 Million to $6 Million per 1.0 million gallons of recycled water supply	Long term
	Promote water recycling and reuse, such as partnering or combining BWS and Waste Water Division functions to improve water efficiencies. Note: This project was combined with the previous Water Supply project. See Project Form WS-2.		
	Expand public education programs and implement measures for demand and resource conservation.	$1,500,000	Long term

6.3 Summary of "Other" Priority Projects

"Other" priority projects for each sector as voted on and agreed to by the committee are as follows:

Oahu Drought Committee Other Priority Drought Mitigation Projects	
Drought Impact Sector	**Mitigation Project Description**
Wildland Fire and Environment	Complete more detailed wildfire hazard analysis, including consideration of risk/hazard/value relationships.
	Improve aerial fire-fighting capability.
	Update Intergovernmental Agreements.
	Develop low-flow instream flow standards for environmental protection (native aquatic fauna) during drought. Have an alternate standard to keep water in streams. With drought and the loss of habitat, native species will return, and alien/invasive species may be eliminated.
	Inventory potential areas for harvesting guinea grass and forage prior to drought to reduce fire danger.
	Develop a matrix of projects to compare commonalities among projects across different sectors.
	Provide additional Wildland Fire training for conservation personnel.
	Review the fire code for mitigative provisions and talk with construction personnel and insurance companies about fire mitigation.
	Develop recommendations for new regulations requiring registration and use of off-road vehicles, dirt bikes – trespassing, fire hazard, nuisance issues.
Agriculture and Commerce	Expand agricultural and commerce education and outreach for water conservation practices including roadside vegetation management, composting of soils, etc.
	Explore ways to have more sub-county area federal drought declarations. Relates to the need for remote weather stations.
	Explore combining drought forecasting with economic models for improved farmer decision-making. This could be built from elements of present federal water management practices, but more Hawaii-specific adaptation is needed for local crops and conditions.
	Inventory and assess private irrigation systems for possible future drought mitigation purposes, such as Lake Wilson.

Oahu Drought Committee Other Priority Drought Mitigation Projects	
Drought Impact Sector	**Mitigation Project Description**
Water Supply	Explore potential use of the current storage capacity contained in Lake Wilson for emergency drought purposes. Also explore the use of Nuuanu Reservoir No. 4.
	Look at developing incentives for recharging caprock supplies with non-potable water (i.e., State policy, water quality considerations, etc).
	During drought, have a dual system to retrieve sewer effluent or gray water for blending for agricultural use. Public perceptions need to be overcome. Separate exemptions for use during drought. Kunia, Waialua, and Waianae are potential areas where separate reservoir could be developed. May be used depending on water quality, crop type, and irrigation method.
	Expand rebate program for new water-saving technologies (e.g. BWS could provide incentives for installation).
	Study the feasibility of installing bulkheads in windward water development tunnels to increase water storage and stream flow. *
	Improve monitoring capability between responsible agencies, BWS, CWRM and USGS to collect and share hydrologic, groundwater and stream flow data as indicators prior to, during and after droughts. Develop a comprehensive operations plan that optimizes groundwater pumpages among Oahu's primary aquifers and provides for sufficient aquifer recovery post drought to maintain aquifer health. *

* Note: These projects were not discussed during the first workshop day and are not reflected in Section 5.3.3.

7 SUMMARY AND RECOMMENDATIONS

Members of the Oahu Drought Committee actively participated in a set of facilitated workshop sessions to develop mitigation strategies with the purpose of proactively addressing the impacts of drought at the County and local level. Representatives from agencies and organizations shared local knowledge and information about current drought conditions, past experiences in dealing with drought, and collectively developed local and regional drought mitigation strategies to minimize the impacts and reduce the risk of drought upon the domestic and municipal water supply, wildland fire-prone areas, agricultural operations, commerce, and the environment.

The workshops were successfully concluded with the identification of 12 "High" priority projects, which are categorized as they relate to the major drought impact sectors of wildland fire, agriculture, and water supply. These priority projects can be

pursued by the Committee and associated lead agencies for funding for immediate and long-term implementation.

7.1 Recommendations and Issues to Consider in Future Drought Mitigation Planning

The following issues were discussed in the workshops and should be considered in future drought mitigation planning. These recommendations are consistent with the goals and objectives of the Hawaii Drought Plan.

7.1.1 Formalization of the Oahu Drought Committee

The Oahu Drought Committee agreed to convene regular meetings and work towards implementing the priority mitigation projects identified during the workshop process. The Oahu Drought Committee should consider whether it should become a formalized entity through recognition by the Mayor or the Oahu Disaster Mitigation Council.

7.1.2 Project Implementation and Funding Strategy

Project implementation should be focused on those projects that have been identified as having an immediate need and which are most easily achieved. The Oahu Drought Committee should seek planning or project funding opportunities through existing government programs, private foundation grants, and county, State, or federal appropriations. Forming partnerships with existing groups (i.e., watershed partnerships, water user cooperatives, etc.) and coordinating mitigation projects will help leverage any funding opportunities or cost-sharing requirements.

7.1.3 Oahu Drought Mitigation Strategy Update

This report has been prepared in manner such that it could be readily incorporated into the City and County of Honolulu's Multi-Hazard Pre-Disaster Mitigation Plan or function as a stand-alone report. The Oahu Drought Committee should work together with the Oahu Disaster Mitigation Council to ensure that this report's findings are represented in the next revision of the County's Multi-Hazard Pre-Disaster Mitigation Plan. This report should be evaluated and updated on a regular basis in consultation with the Oahu Disaster Mitigation Council.

7.1.4 Drought Impact Assessment/Post-drought Evaluation

In order to effectively document the impacts of drought, the Oahu Drought Committee should work with the Hawaii Drought Council and the State Drought Coordinator to apply a standardized methodology to document economic, environmental, and social drought impacts. A post-drought evaluation is also recommended to evaluate the efficacy of mitigation and response actions executed by government and private sector organizations, and to make recommendations for improvement.

7.1.5 Drought Response Project Identification

Although this report focuses on preparedness and mitigation, there may be circumstances where emergency assistance is necessary to alleviate drought impacts to stakeholders. Limited federal program funding may be available to help with emergency drought relief. In these cases the Oahu Drought Committee should assess and identify these needs within the community and provide a detailed description of drought assistance projects to the State Drought Coordinator, who will submit project proposals from all affected counties for any available federal program assistance.

7.2 Future Oahu Drought Committee Operational Activities

The Oahu Drought Committee agreed to conduct meetings at least semi-annually. Critical times for meetings include: 1) December - prior to the Hawaii legislative session and the upcoming Congressional session, and 2) June – just prior to the end of the Federal fiscal year when funds may become available upon short notice. Messrs. Doug Aton, Acting Administrator for Oahu Civil Defense, Barry Usagawa, Principal Executive of Water Resources, Honolulu Board of Water Supply, and Jason Shitanishi, County Executive Director, U.S. Department of Agriculture, Farm Service Agency, have volunteered to co-chair the Committee. Members are urged to collaborate on the development of meeting agendas and to share responsibilities for meeting coordination.

7.3 Project Forms

For identified high priority projects, Committee members developed more detailed project descriptions using the format provided by the State Hazard Mitigation Forum. A project form was used to enable consistent project descriptions and includes general project justification and cost information to support the pursuit of project funding and implementation. Specific project details should be developed upon selection of a project for implementation. Projects submitted for FEMA Pre-Disaster Mitigation grant funding will require detailed documentation of project costs, development of quantitative estimates of project benefits, and a benefit-cost analysis.

The project forms are provided for reference on the following pages. These forms should be updated and revised as more information becomes available.

Index of Project Forms

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-1

<table>
<tr><td colspan="2">Jurisdiction: City & County of Honolulu</td><td colspan="2">Agency/Organization: DLNR/Forestry and Wildlife</td></tr>
<tr><td colspan="2" rowspan="3">Project Title:
Firewise Coordinator</td><td colspan="2">Contact Person: Wayne F. Ching</td></tr>
<tr><td colspan="2">Phone: 808-587-4173</td></tr>
<tr><td colspan="2">e-mail: wayne.f.ching@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Wildfire</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Communities at risk from wildfires</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $50,000</td><td colspan="2">Project Period (duration): annual</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: DLNR/City & County of Honolulu/Koolau Watershed Partnership/et al.</td></tr>
<tr><td colspan="4">Project Objectives:
Provide Oahu's communities at risk with options and guidelines to protect their homes from wildfires; promote the use of Firewise in these communities; provide information and workshops pertaining to fire prevention and Firewise.</td></tr>
<tr><td colspan="4">Project Description:

Contract a Firewise Coordinator who will provide overall guidance and leadership of meeting the goals and objectives of the project.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-4

<table>
<tr><td colspan="2">Jurisdiction: City & County of Honolulu</td><td colspan="2">Agency/Organization: HFD, DLNR, DOA, HBWS, ADC, Military, USFWS, Private Irrigation Systems</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: WF-4 Inventory and maintain fire fighting water sources with consideration to threatened and endangered species, develop protocols for salt water use, use of GIS supporting technology.</td><td colspan="2">Contact Person: Pat Costales</td></tr>
<tr><td colspan="2">Phone: 973-9787</td></tr>
<tr><td colspan="2">e-mail: Patrick.G.Costales@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Wildfire</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk: Wildland-urban interface areas, agricultural/industrial areas, watersheds, native ecosystems, general public</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $100,000-$125,000</td><td colspan="2">Project Period (duration): Long Term</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: Irreplaceable historic irrigation/distribution systems</td></tr>
<tr><td colspan="4">Sources of Financial Support: Private irrigation system owners, HBWS, military, USDA, State of Hawaii, BOR, USFWS</td></tr>
<tr><td colspan="4">Project Issue: Wildland fires occur (on Oahu) frequently in places where municipal water supply is not readily available to facilitate a safe and effective tactical response. Additionally, T & E Sp. Horticultural facilities/outplanting sites are in remote locations and often without adequate irrigation facilities, which exacerbate their chances for survival.

Project Objectives: 1) Inventory irrigation/distribution and reservoir systems (potable/non-potable), 2) Develop decision protocols when can/cannot use salt water to suppress wildfires, 3) Expand use of GIS technologies in support of wildland firefighting.</td></tr>
</table>

Project Description:

1) Conduct inventory: a. Water Systems (Ag/Municipal) to include assessment of their condition b) Determine suitability for firefighting. c) Compile a user's guide for fire service responders and horticultural providers. Note: Refer to DOA's Ag Water Use and Development Plan, Other irrigation system references; develop POC listing for water systems, etc.

2) Develop decision making protocols for use of salt water, with special consideration for threat impact to T/E Species, public and firefighter safety, property damage, etc. and share findings with the Oahu wildland fire coordinating group.

3) Improve GIS technologies to support fire management activities: a) Develop a conventional risk-hazard-value analysis system, b) Develop GIS info layers for water systems-agricultural/municipal, c) develop communications network to output GIS products—Phase 1: Maps (Hardcopy), Phase 2: Field operations-stand alone and internet capabilities.

Special Note: Above cost estimate is low but should meet current need; cost can easily increase tenfold if roll in maintenance/improvement cost per system (See cost estimates for Waiahole/Waimanalo Systems; can easily apply to the other 8 systems which may be in operation on Oahu).

Proposal Date: September 2004

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-5

Jurisdiction: City & County of Honolulu		**Agency/Organization:** DLNR/Forestry and Wildlife
Project Title: Fuel hazard reduction within the wildland urban interface		**Contact Person:** Wayne F. Ching **Phone:** 808-587-4173 **e-mail:** wayne.f.ching@hawaii.gov
Hazard(s): Wildfire		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: DOFAW mapped **c**ommunities at risk from wildfires		
Environmental Impact: **High** **Medium** **Low**		**Historical Preservation Impact:** **High** **Medium** **Low**
Risk of Hazard Impact: **High** **Medium** **Low**		**Importance to Protection of Life and Property and Recovery from Disaster:** **High** **Medium** **Low**
Estimated Cost of Project: Approximately $500,000 annually		**Project Period (duration):** annual
Estimated Value of Structure or Facility:		
Sources of Financial Support: DLNR/DOT/City & County of Honolulu/BWS/USDA/FEMA/et al.		
Project Objectives: Prioritize and conduct fuel hazard reduction projects within the wildland urban interface; assist communities at risk with projects by applying for federal grants targeting fuel hazard reduction projects.		
Project Description: 1. Prioritize the hazardous fuels reduction projects of those communities at risk from wildfires, including the mowing and weed whacking of grass and brush along roadsides and highways. 2. Work with state and county agencies to implement a fuels hazardous reduction plan. 3. Assist communities in applying for a Wildland Urban Interface grant through the U.S. Forest Service.		
Proposal Date: September 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-8

<table>
<tr><td colspan="2">Jurisdiction: City & County of Honolulu</td><td colspan="2">Agency/Organization: DLNR/Forestry and Wildlife</td></tr>
<tr><td colspan="2" rowspan="3">Project Title:
Development of an Oahu Wildfire Coordinating Group</td><td colspan="2">Contact Person: Wayne F. Ching</td></tr>
<tr><td colspan="2">Phone: 808-587-4173</td></tr>
<tr><td colspan="2">e-mail: wayne.f.ching@hawaii.gov</td></tr>
<tr><td colspan="4">Hazard(s): Wildfire</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:
Communities at risk from wildfires/watersheds</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: Minimal initial cost.</td><td colspan="2">Project Period (duration): indefinite</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: DLNR/Honolulu Fire Dept./U.S. Army/USFWS/Federal Fire Dept./Hickam AFB Fire Dept./Nature Conservancy</td></tr>
<tr><td colspan="4">Project Objectives:
Establish and maintain an interagency approach to wildland fire management programs through the development and nurturing of interagency bonding and facilitation of a high degree of professionalism, trust, and mutual assistance among wildland fire management agencies on Oahu.</td></tr>
<tr><td colspan="4">Project Description:
The fire agencies on Oahu who deal with wildfires will form a wildfire coordinating group similar to that of the Big Island Wildfire Coordinating Group and the Maui Wildfire Coordinating Group. The Division of Forestry and Wildlife will initiate the process with the assistance from the U.S. Army and the Honolulu Fire Dept. Initially, meetings will be held quarterly or as deemed necessary to establish a rapport with all agencies.

The National Interagency Incident Management System provides a systems approach for response in emergency situations. NIIMS includes five major subsystems, which together provide a comprehensive approach to incident management. The subsystems include:
1. Incident Command System
2. Training
3. Qualifications and Certification
4. Publications Management
5. Supporting Technology
There should be minimal initial cost to the agencies involved. Costs will be incurred for implementation.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-9

<table>
<tr><td colspan="2">Jurisdiction: City and County of Honolulu</td><td>Agency/Organization: The Nature Conservancy, Division of Forestry and Wildlife, University of Hawaii</td></tr>
<tr><td colspan="2" rowspan="3">Project Title:
Long-Term Ecological Research Experimental Forested Watershed in Hawaii</td><td>Contact Person: Mark Fox</td></tr>
<tr><td>Phone: 537-4508</td></tr>
<tr><td>e-mail: mfox@tnc.org</td></tr>
<tr><td colspan="3">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $100,000 / year</td><td>Project Period (duration): Ongoing, at least 3 years for establishment, w/ minimum 10 years data collection</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility: N/A</td></tr>
<tr><td colspan="3">Potential Sources of Financial Support: University of Hawaii, National Science Foundation LTER Program, US Forest Service Hawaii Tropical Forest Recovery Task Force, US Fish and Wildlife Service, State Dept. of Land and Natural Resources, USGS.</td></tr>
<tr><td colspan="3">Project Objectives:
1) Explore the use of forested watershed management tools to mitigate the effects of drought and improve ground and surface water management.
2) Develop monitoring tools to assess the impact of mitigating measures on water resources.</td></tr>
</table>

Project Description:
LTER (Long-Term Ecological Research) Experimental Forested Watersheds have been in wide use for nearly a century by ecologists as a proven tool to investigate ecosystem level dynamics of forested watershed areas. These LTER sites allow a comprehensive look at the entire system, providing a venue to study how various manipulations of the forest, either natural (such as invasive weeds or pig damage) or anthropogenic (harvesting, reforestation, or fencing) might impact the natural resources in the watershed (water, soil, plants). In Hawaii, although some components of this puzzle have been addressed, there has been no comprehensive effort to date to substantively understand how, from a natural resource perspective, we can best mitigate the effects of drought, protect our water resources, and encourage the healthy growth of our forests. The establishment of the first LTER Experimental Forested Watershed in Hawaii would take a massive step in this direction.

This project proposes to:

1. Determine locations for paired experimental forested watersheds with disturbed (non-native) and native forest vegetation.
2. Develop monitoring protocols and conduct baseline monitoring for native and nonnative forest ecosystems, focusing on such essential components as water budget data (infiltration, evapotranspiration, rainfall and runoff rates), soil erosion/ conservation rates, droplet size and rainfall impacts, biodiversity, forest biomass, forest health/disease, or forest composition.
3. Conduct drought mitigation projects expected to improve the capacity of the forest to function as a healthy watershed. Examples include invasive weed species control, native species outplanting, feral ungulate control, and riparian restoration.
4. Re-measure monitoring indicators and compare to baseline to evaluate the efficacy of drought mitigation and watershed health improvement strategies.

Proposal Date: September 2004

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WF-11

Jurisdiction: City & County of Honolulu		**Agency/Organization:** DLNR/Forestry and Wildlife, Hawaii Farm Bureau
Project Title: Installation of Remote Automated Weather Stations (RAWS)		**Contact Person:** Wayne F. Ching **Phone:** 808-587-4173 **e-mail:** wayne.f.ching@hawaii.gov
Hazard(s): Wildfire		
Flood Zone:	**Base Flood Elevation:**	**Erosion Rate:**
Critical Facility/Population/Asset at Risk: Watershed, Natural resources (Threatened & Endangered species)		
Environmental Impact: **High** **Medium** **Low**		**Historical Preservation Impact:** **High** **Medium** **Low**
Risk of Hazard Impact: **High** **Medium** **Low**		**Importance to Protection of Life and Property and Recovery from Disaster:** **High** **Medium** **Low**
Estimated Cost of Project: $210,000		**Project Period (duration)** Indefinite
Estimated Value of Structure or Facility:		
Sources of Financial Support: State/BWS/County/USFWS/Koolau Mt. Watershed Partnership		
Project Objectives: Purchase and install twelve (12) RAWS units to capture microclimate data for area closures and pre-staging for mobilization of fire equipment.		
Project Description: The acquisition of 12 RAWS units will be used to mitigate the wildfire threat to Oahu. The units also can provide data to the National Weather Service, State Civil Defense, and the Oahu Civil Defense Agency or emergency services regarding the management of natural disasters. Agricultural users could also use the data to monitor rainfall. Acquisition cost for 12 RAWS is estimated at $192,000. Annual maintenance for the 12 units is estimated at $20,000.		
Proposal Date: September 2004		

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM AC-2&3

<table>
<tr><td colspan="2">Jurisdiction: Statewide</td><td colspan="2">Agency/Organization: Hawaii Farm Bureau</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Amend existing Federal and State Laws to recognize a comprehensive drought program in Federal and State legislation as a natural disaster with proactive mitigation and response.</td><td colspan="2">Contact Person: Paul Matsuo</td></tr>
<tr><td colspan="2">Phone: 839-5040</td></tr>
<tr><td colspan="2">e-mail: pgmatsuo@yahoo.com</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone: none</td><td colspan="2">Base Flood Elevation: n/a</td><td>Erosion Rate: n/a</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk: Agricultural, Residential, and Commercial water users.</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: unknown</td><td colspan="2">Project Period (duration): Long Term</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: n/a</td></tr>
<tr><td colspan="4">Sources of Financial Support: State appropriation or private funds for legal services</td></tr>
<tr><td colspan="4">Project Objectives:
To provide more comprehensive programs for diverse interests in providing relief from drought and mitigating and responding to drought in the future.</td></tr>
<tr><td colspan="4">Project Description:
Presently disaster statutes both at federal and state level do not consider drought as qualifying for assistances nor relief. The activity in this proposal is to correct that and have droughts be included in the definition of natural disaster. Also to amend existing regulations to correct present definitions.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM AC-5

<table>
<tr><td colspan="2">Jurisdiction: City and County of Honolulu</td><td colspan="2">Agency/Organization: Mayor's Office, Department of Environmental Services, BWS</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Increase the amount of effluent available for reuse, develop strategies and pilot projects to reduce institutional hurdles</td><td colspan="2">Contact Person: Steve Holmes</td></tr>
<tr><td colspan="2">Phone: 523-4714</td></tr>
<tr><td colspan="2">e-mail: sholmes@co.honolulu.hi.us</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk: General population and potable water resources.</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $3 Million (operational plant)</td><td colspan="2">Project Period (duration): Long-term</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: Honolulu BWS, Sewer charges, EPA revolving fund</td></tr>
<tr><td colspan="4">Project Objectives:
De-centralize sewer treatment and increase opportunities for re-use at nearby demand areas, by use of on-site "package" treatment plants.</td></tr>
<tr><td colspan="4">Project Description:
Develop strategies and resolve institutional hurdles to guide the overall vision for increasing the availability of effluent for reuse. Based upon the findings, develop a project to demonstrate the technology and feasibility of on-site package treatment facilities. Develop financing models to fund these projects. If successful, this concept can be implemented in new developments and retrofit existing developments. There is a potential for savings of millions of gallons of potable water per day by reducing irrigation water demand.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM AC-6

<table>
<tr><td colspan="2">Jurisdiction: City and County of Honolulu, Statewide</td><td colspan="2">Agency/Organization:
USDA Farm Service Agency – Honolulu County</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Documenting Agricultural and Other Commercial Losses Due to Drought</td><td colspan="2">Contact Person: Jason Shitanishi, CED</td></tr>
<tr><td colspan="2">Phone: (808) 483-8600, #104</td></tr>
<tr><td colspan="2">e-mail: jason.shitanishi@hi.usda.gov</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project:</td><td colspan="2">Project Period (duration) – Ongoing</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility: Not Applicable</td></tr>
<tr><td colspan="4">Sources of Financial Support: United States Department of Agriculture</td></tr>
<tr><td colspan="4">Project Objectives:
Develop a system and methodology to document and maintain databases of agricultural and other commercial drought losses, rather that individual farmer documentation of losses. NRCS is developing a process to monitor and track conditions.</td></tr>
<tr><td colspan="4">Project Description:

Assemble a qualified third party agency or entities (i.e. NRCS or extension service, local University) to develop a methodology, strategy, and cost estimates to implement a system to monitor drought conditions and track drought related losses.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM AC-7

<table>
<tr><td colspan="2">Jurisdiction: City and County of Honolulu</td><td colspan="2">Agency/Organization: Mayor's Office, Department of Planning and Permitting, University of Hawaii</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Improve the Use of Remote Sensing and the City's GIS System to Monitor Drought and Climatic Changes</td><td colspan="2">Contact Person: Ken Schmidt</td></tr>
<tr><td colspan="2">Phone:</td></tr>
<tr><td colspan="2">e-mail:</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td colspan="2">Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk:</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $50,000 - $100,000</td><td colspan="2">Project Period (duration): Six to Eighteen Months</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: City and County of Honolulu</td></tr>
<tr><td colspan="4">Project Objectives:
To better coordinate the use of remote sensing (satellite) data with the City's GIS system to monitor drought and climatic changes. Make this data and analysis available to stakeholders in order to prepare for and mitigate drought.</td></tr>
<tr><td colspan="4">Project Description:
Coordinate the use of remote sensing (satellite) data with the City's GIS system. Develop analysis tools to use remote sensing data to monitor drought conditions and climatic changes. Develop a system for data and analysis dissemination to the stakeholders and public for improved drought monitoring, mitigation, and response.</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WS-2

<table>
<tr><td colspan="2">Jurisdiction: Statewide</td><td>Agency/Organization: DOH, DOA, BWS, ENV</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Expand Reuse, Brackish Water and Blending Applications</td><td>Contact Person: Barry Usagawa, Water Resources, Honolulu Board of Water Supply</td></tr>
<tr><td>Phone: 748-5900</td></tr>
<tr><td>e-mail: busagawa@hbws.org</td></tr>
<tr><td colspan="3">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td>Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="3">Critical Facility/Population/Asset at Risk: General Population, Agriculture, Urban Uses</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td>Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td>Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $4 to $6 million per million gallon of source capacity</td><td>Project Period (duration) Various Projects, 5 years</td></tr>
<tr><td colspan="3">Estimated Value of Structure or Facility: Various</td></tr>
<tr><td colspan="3">Sources of Financial Support: BWS Water Rates, ENV Sewer Rates, DOH Revolving Fund, Federal Grants and Loans</td></tr>
<tr><td colspan="3">Project Objectives:

1. Identify and resolve economic and institutional barriers related to recycled water.
a. Economics/business case analysis must balance affordability to consumers while providing sufficient recovery of capital and operation and maintenance costs to the supplier. Acquiring and sustaining government subsidies are a challenge. Recognizing capital avoidance to water and wastewater infrastructure. Regulations restricting effluent disposal in lieu of reuse as an economic incentive, i.e. Wahiawa wastewater treatment plant & Lake Wilson.
b. Institutional barriers for agriculture: farmer and consumer acceptance, marketability, liability and risk management of agricultural produce, i.e. Diversified agriculture has reservations on using recycled water. For urban users, perceived impacts to public health and safety and to drinking water supplies.</td></tr>
</table>

2. Develop strategies and solutions to promote recycled water projects and its use.
   a. Develop partnerships and joint development agreements among utilities, users and regulatory agencies.
   b. Provide user education, marketing and regulatory compliance assistance.
   c. Reduce the liability and risk to farmers from using recycled water through legislation.

3. Plan, fund, design and construct recycled water projects to expand Oahu's capability to reduce drought impacts.

Project Description:

1. Convene the Reuse Champions group of recycled water stakeholders, to scope and address the economic and institutional barriers that restrict the expansion of recycled water to agricultural and urban users. Build partnerships, educate users and obtain legislation to reduce liability and risk and provide funding to benefit farmers.

2. Develop the following list of recycled and brackish water projects:

Waimanalo Recycled Water System

The State legislature funded about $18 million for upgrades to the Waimanalo wastewater treatment plant to expand treatment capacity and potentially produce R-1 recycled water. If R-1 capacity is produced, distribution storage and piping could extend to the polo field & adjacent parks. Connection to the State Dept. of Agriculture, DOA, nonpotable irrigation system will increase source of supply in the system that historically is impacted by drought.
Average Day production = 1.0 to 2.0 mgd

Ewa Nonpotable System Expansion

Honouliuli water recycling facility (WRF) produces 10 mgd R-1 and 2 mgd Reverse Osmosis demineralized water for irrigation and industrial process water, respectively. Ewa is a designated growth area where the secondary urban center of Kapolei is located. The nonpotable distribution system is master planned to deliver about 26 mgd of recycled water through about 40 miles of pipeline. Brackish wells will be evaluated and connected to increase source capacity until the WRF is expanded and later for reliable back-up supply.

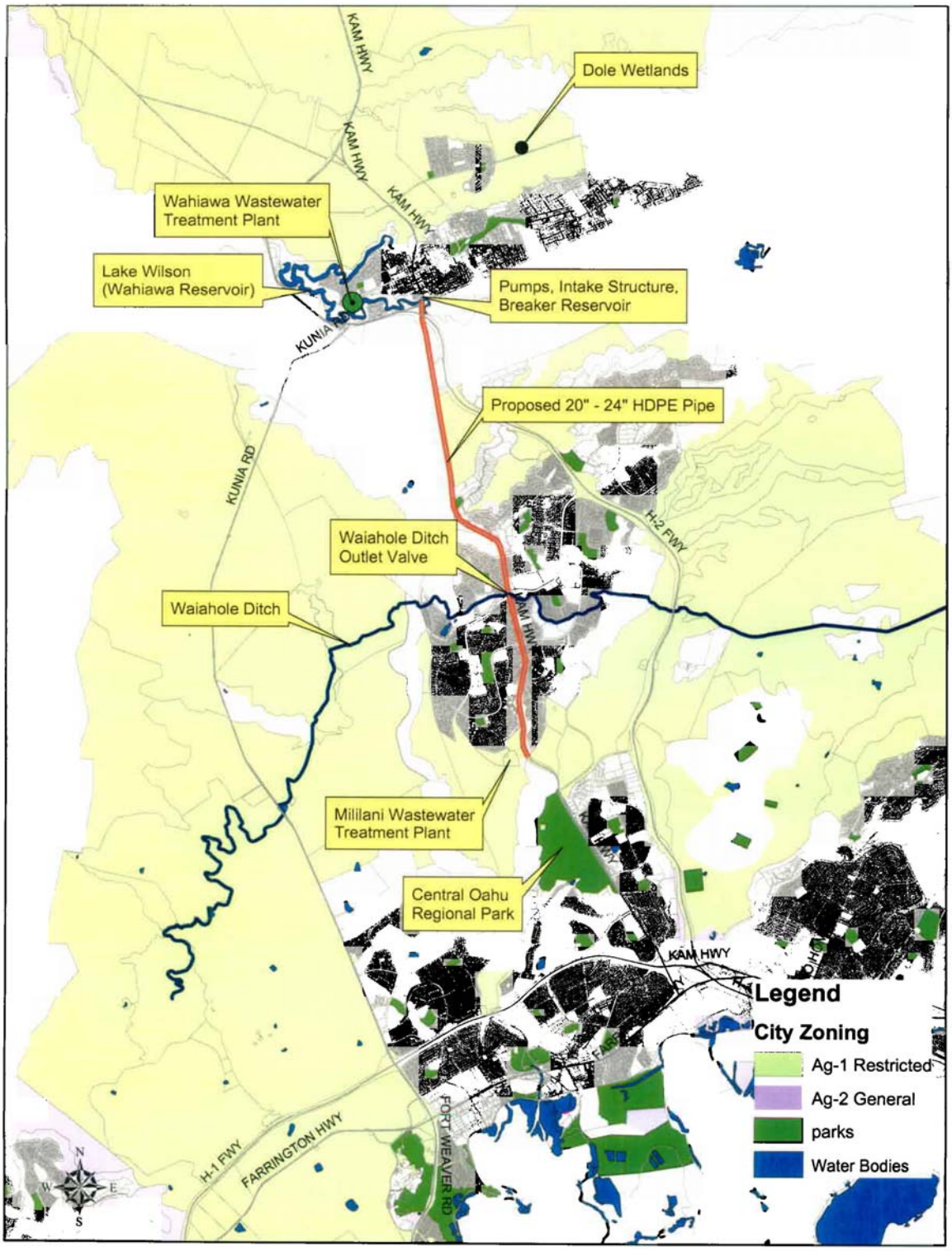
Wahiawa Recycled Water System for Central Oahu

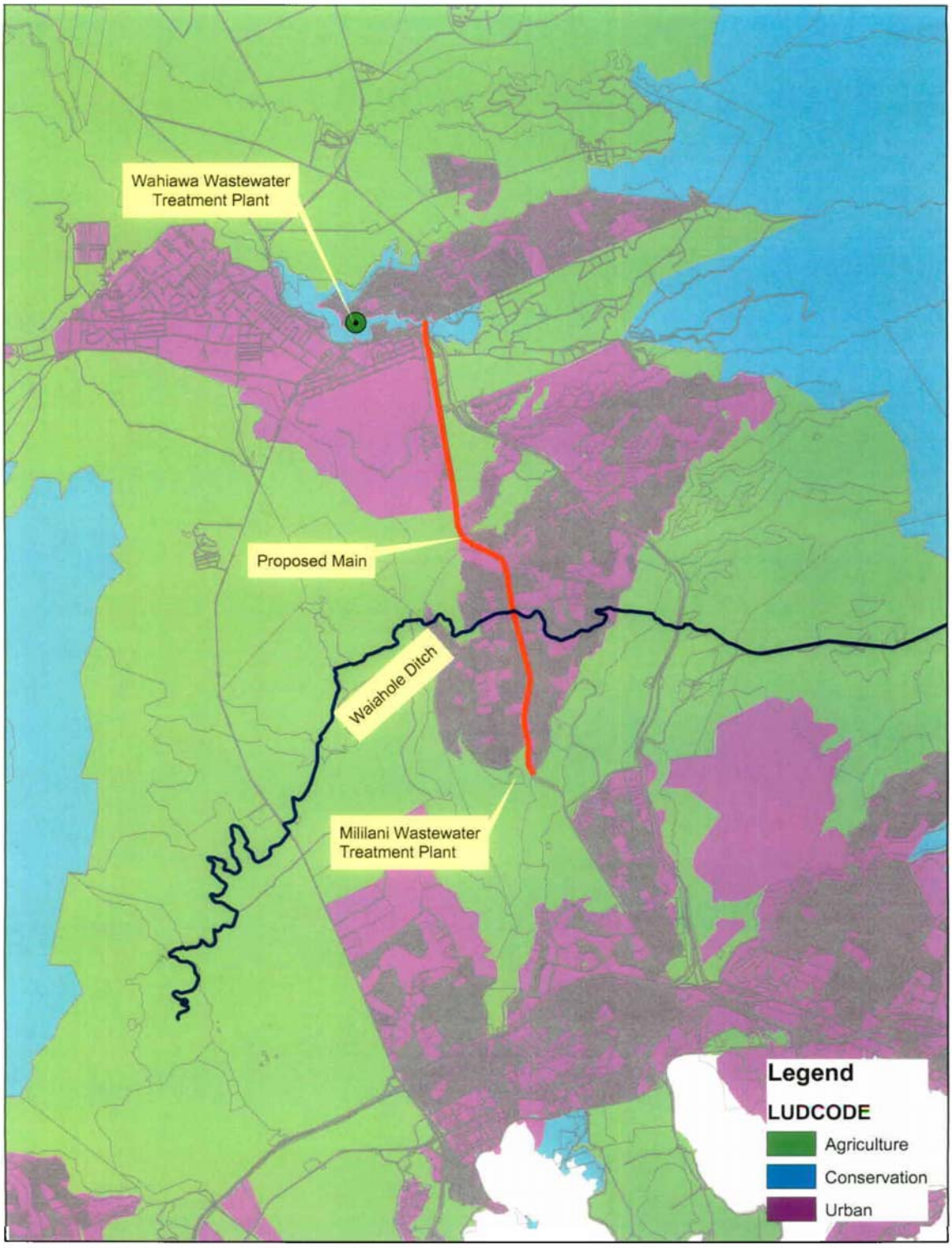
Wahiawa wastewater treatment plant processes about 2.0 mgd average day flow to tertiary levels and discharges the effluent into Lake Wilson. City ENV will be funding additional UV capacity and reject water storage to allow DOH certification as a R-1 facility. BWS is designing a transmission pipeline from the wastewater treatment plant along Kamehameha Hwy. to Central Oahu Regional Park, 0.7 mgd. Waiawa Gentry is planning to use about 1.2 mgd for its proposed golf courses. Mililani GC and District Park are also potential users. The Waiahole Ditch crosses the pipeline alignment, so there are possible agricultural uses. Goal is to eliminate all wastewater effluent into Lake Wilson. If the Army upgrades its Wheeler wastewater treatment plant to R-1 level, the effluent discharges into the old Waialua Sugar Co. irrigation system below the lake, could be improved. Waialua & Kawailoa diversified agriculture will then have an abundant supply of R-1 and stormwater impounded water from the lake.

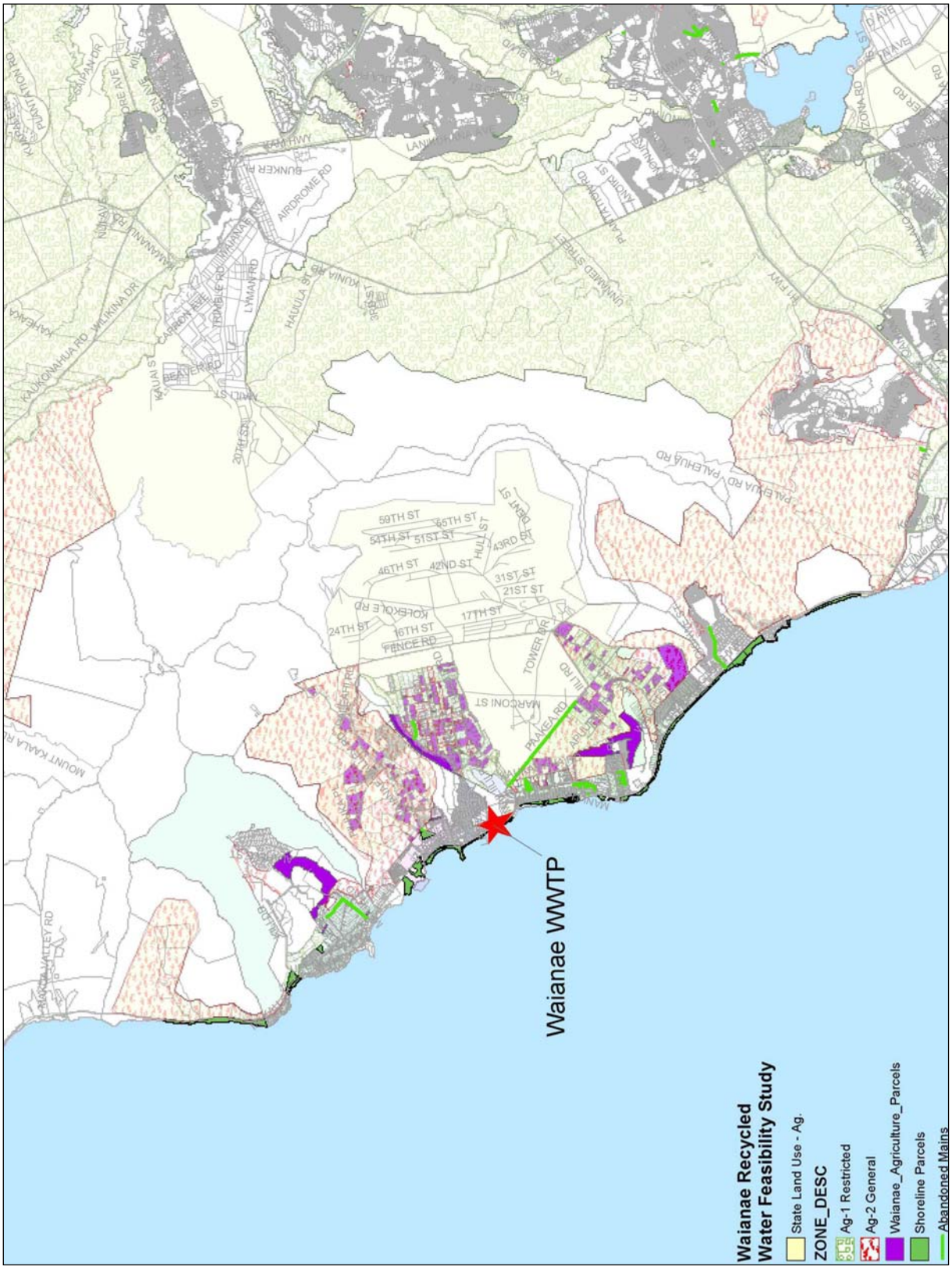
Waianae Recycled Water System

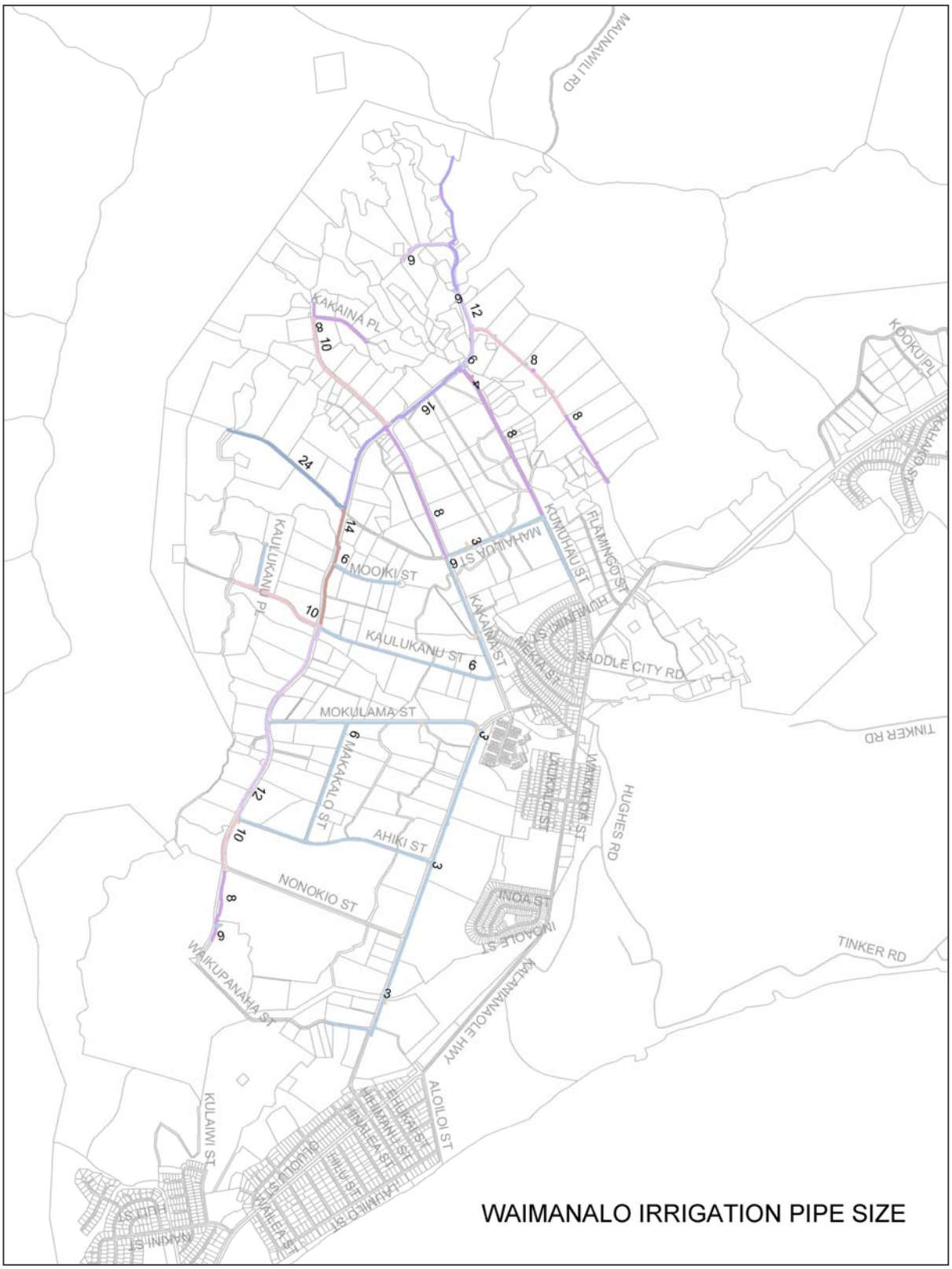
Waianae wastewater treatment plant discharges about 3.0 mgd of secondary treated effluent into the ocean. BWS is conducting an engineering study to recycle about 2 mgd R-1 for Waianae's parks and agriculture, which currently use potable water for irrigation. The study is evaluating the rehabilitation of old water distribution pipeline surrounding the wastewater treatment plant, which was recently replaced.

Proposal Date: Ongoing 5-year plan


Dole Wetlands
Wahiawa Wastewater Treatment Plant
Lake Wilson (Wahiawa Reservoir)
Pumps, Intake Structure, Breaker Reservoir
Proposed 20" - 24" HDPE Pipe
Waiahole Ditch Outlet Valve
Waiahole Ditch
Mililani Wastewater Treatment Plant
Central Oahu Regional Park
KAM HWY
KUNIA RD
H-2 FWY
H-1 FWY
FARRINGTON HWY
FORT WEAVER RD
Legend
City Zoning
Ag-1 Restricted
Ag-2 General
parks
Water Bodies


Wahiawa Wastewater Treatment Plant
Proposed Main
Waiahole Ditch
Mililani Wastewater Treatment Plant
Legend
LUDCODE
Agriculture
Conservation
Urban


Waianae WWTP
Waianae Recycled
Water Feasibility Study
State Land Use - Ag.
ZONE_DESC
Ag-1 Restricted
Ag-2 General
Waianae_Agriculture_Parcels
Shoreline Parcels
Abandoned Mains


MAUNAWILI RD
KAKAINA PL
KOOKUI PL
KAHAKO ST
KAULUKANU PL
MOOKI ST
KAULUKANU ST
MAHALOA ST
KUMUHAU ST
FLAMINGO ST
KAKAINA ST
HUIHUIMANU ST
MEKA ST
SADDLE CITY RD
MOKULAMA ST
MAKAKALO ST
LAUKAU ST
WAIKALUA ST
TINKER RD
HUGHES RD
AHIKI ST
NONOKIO ST
INOA ST
INOAOLE ST
WAIKUPANAHA ST
KALANIANAOLE HWY
TINKER RD
KULAWI ST
ALOILO ST
HUEMANU ST
EELEKA ST
PINALEA ST
LAUMILO ST
OLUOLU ST
WAILEA ST
KAKINI ST
WAIMANALO IRRIGATION PIPE SIZE

HAWAII HAZARD MITIGATION PROJECT IDENTIFICATION FORM WS-6

<table>
<tr><td colspan="2">Jurisdiction: City and County of Honolulu</td><td colspan="2">Agency/Organization: BWS, HECO, State agencies</td></tr>
<tr><td colspan="2" rowspan="3">Project Title: Expand public education programs and implement measures for demand and resource conservation</td><td colspan="2">Contact Person: Jon Yoshimura</td></tr>
<tr><td colspan="2">Phone: 748-5316</td></tr>
<tr><td colspan="2">e-mail: jyoshimura@hbws.org</td></tr>
<tr><td colspan="4">Hazard(s): Drought</td></tr>
<tr><td>Flood Zone:</td><td colspan="2">Base Flood Elevation:</td><td>Erosion Rate:</td></tr>
<tr><td colspan="4">Critical Facility/Population/Asset at Risk: General Population, Municipal Water System, Ground water aquifers</td></tr>
<tr><td colspan="2">Environmental Impact:
High Medium Low</td><td colspan="2">Historical Preservation Impact:
High Medium Low</td></tr>
<tr><td colspan="2">Risk of Hazard Impact:
High Medium Low</td><td colspan="2">Importance to Protection of Life and Property and Recovery from Disaster:
High Medium Low</td></tr>
<tr><td colspan="2">Estimated Cost of Project: $1.5 Million annually</td><td colspan="2">Project Period (duration): Long-term</td></tr>
<tr><td colspan="4">Estimated Value of Structure or Facility:</td></tr>
<tr><td colspan="4">Sources of Financial Support: BWS, HECO</td></tr>
<tr><td colspan="4">Project Objectives:
Expand public education for water conservation and science and provide incentives for demand side management practices (e.g., reward consumer water savers) to mitigate the effects of drought and disaster recovery.</td></tr>
<tr><td colspan="4">Project Description:
Develop enhanced public education and science programs for water conservation. Develop additional incentive programs for water conservation practices for BWS customers (i.e., rebates and rewards).</td></tr>
<tr><td colspan="4">Proposal Date: September 2004</td></tr>
</table>

8 REFERENCES

City and County of Honolulu, Oahu Civil Defense Agency, *Multi-Hazard Pre-Disaster Mitigation Plan for the City and County of Honolulu*, 2003

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Hawaii Drought Plan*. Prepared by Wilson Okamoto Corporation, December 2004.

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. Prepared by University of Hawaii, Social Science Research Institute, September 2003.

State of Hawaii, Department of Defense, Civil Defense Division. *State of Hawaii Hazard Mitigation Plan*. Draft, December 2004.

State of Hawaii, Department of Agriculture. *Agricultural Water Use and Development Plan.* Draft, December 2003.